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Milestone Study on Paper Waste Management in the US and Canada

Transforming Recycling and Solid Waste Management in the US and Canada

Executive Summary

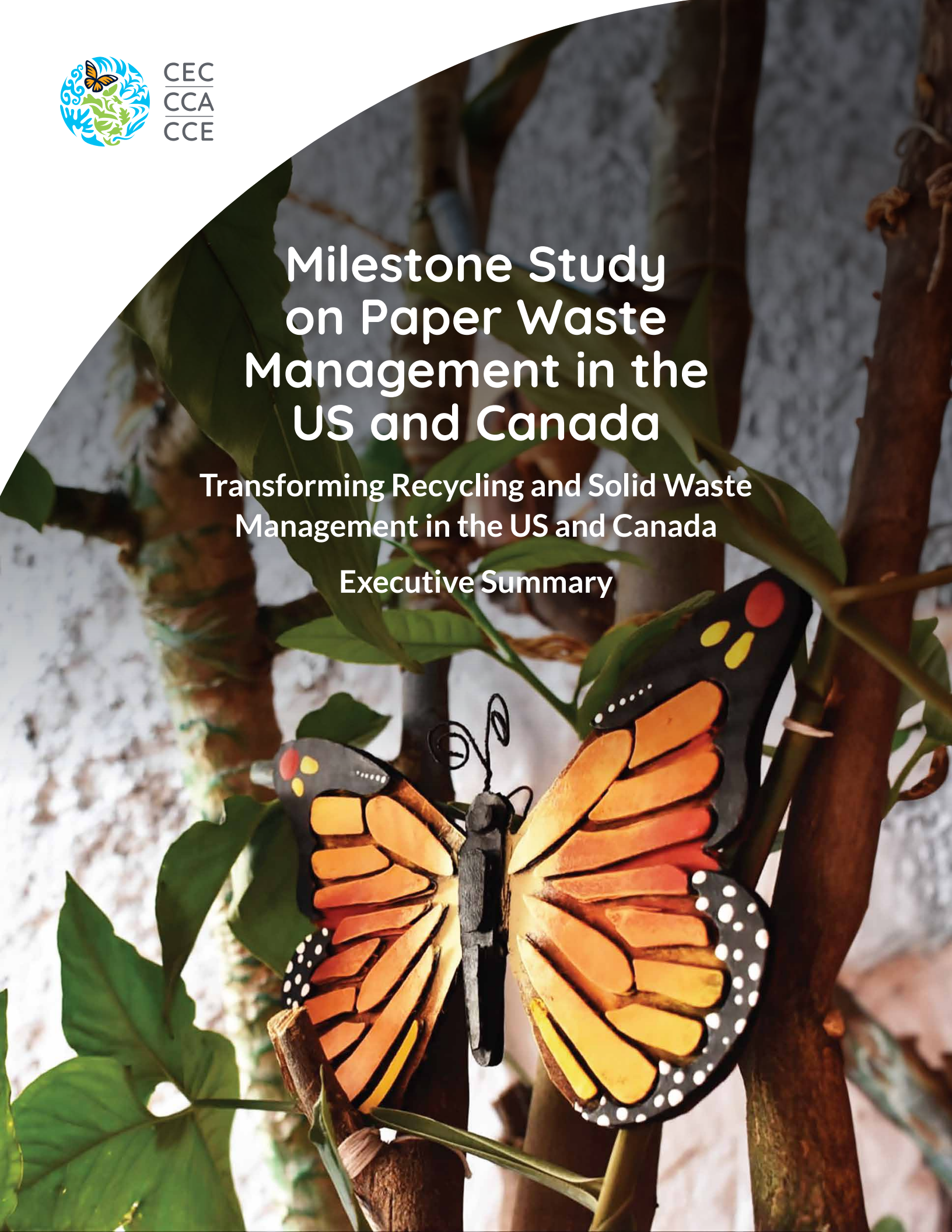

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*Photo credit – Cover: Monarch Butterfly made of recycled corrugated cardboard by Elizabeth Romo-Rabago from Ciclomanias. https://www.ciclomanias.com

1 Study Context and Scope

The Commission for Environmental Cooperation (CEC) has commissioned this study as part of its Operational Plan 2021 Project "Transforming Recycling and Solid Waste Management in North America"[1], with the goal of promoting circular economy and sustainable materials management approaches and bring economic and environmental benefits to the region. The project supports Canada, Mexico and the United States in their efforts to promote circular economy and sustainable materials management approaches to encourage eco-design and thus increase product and material reuse, recovery, and recycling rates.

This publication represents one of a series of three milestone studies which aim for better understanding of the opportunities in the recycling sector and secondary material markets for paper, plastics, and bioplastics waste. The content focuses on the US and Canada, and a separate set of these studies focused on Mexico will be available in the upcoming months. Building on the results of these milestone studies and on stakeholder input, the project will carry out pilot testing projects in a second phase designed to assess the feasibility of innovative technologies, policies, or practices for adoption at scale across North America.

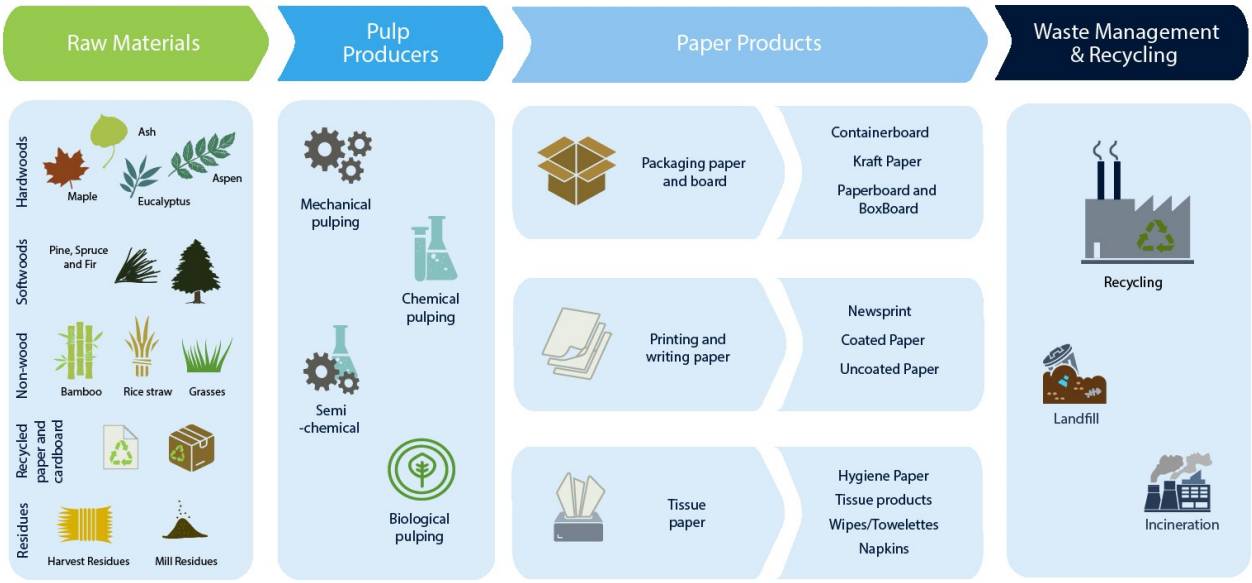
The following report is the milestone study on paper waste (plastics and bioplastics waste are covered by separate publications). It presents, in terms as comprehensive as the available data allow[2], a picture of the current state of paper circularity, the barriers to further circularity, and opportunities for overcoming these barriers. Information presented in this study is designed to support stakeholder collaboration and knowledge-sharing and provide policy makers with evidence-based recommendations for improving paper waste management and circularity in Canada and the US. It does this by examining the state of play along the paper value chain in each of the two countries, including sustainable product and packaging designs, recycling and recovery markets, secondary materials markets, and current and proposed policy and regulation related to paper. It also considers best practice, emerging technologies, and policy options deployed elsewhere in the world.

The scope of this milestone study is post-consumer paper waste from residential and commercial sources, covering all discarded paper, prior to any decision on whether it is suitable for recycling. The value chain for paper encompasses the production of a range of paper products from raw materials (i.e., fibers), including packaging paper and board, printing and writing paper, and tissue paper, through to the waste management of these products at end-of-life. The paper value chain is depicted in Figure 1.

[1] CEC Operational Plan 2021 Project. "Transforming Recycling and Solid Waste Management in North America."

[2] This study considers the information and data available by December 2023.

Figure 1. Paper value chain



Source: Eunomia Research & Consulting

2 Research Method

The information presented in this milestone study was gathered through secondary, desk-based research, analyzing existing relevant publications and databases, and primary research through consultation with key stakeholders in paper waste management in each country. A wide range of sources were used, ranging from international databases provided by the United Nations (UN) to state- and provincial-level responses to requests under the US Freedom of Information Act (FOIA) and the Canadian Access to Information Act (ATIA).

Based on the available data, a methodology was developed to generate a material flow for paper products in Canada and the US. The methodology enabled paper waste to be traced throughout the supply chain, from the production and consumption of paper products through to the collection, sorting and reprocessing of paper waste. At each stage of the process, the losses from the system were quantified. The purpose of this analysis was to establish a baseline from which policy makers, service providers, operators, and investors can make informed strategic decisions on what measures are needed in the short-, medium-, and long-term to support a circular economy, replace virgin material consumption in production with secondary materials, and reduce greenhouse gas (GHG) emissions.

Throughout the report, where available, relevant market data and policy information are provided for individual federal states in the US and provinces/ territories in Canada.[3]

[3] There are 50 federal states in the United States. Canada is composed of 10 provinces and three territories.

3 Key Findings

3.1 Material Flows and Waste Management

United States

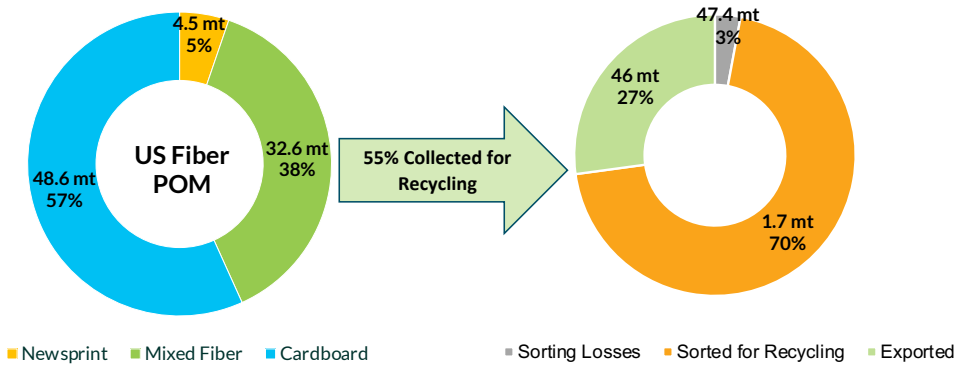
It is estimated that, in 2021, approximately 85.7 million tonnes of paper were placed on the market (POM) in the US. This tonnage comprised domestic production, which equaled 67.3 million tonnes (79%) and the net imports of paper products, which totaled approximately 18.4 million tonnes (21%). The majority of paper products POM were cardboard, accounting for approximately 49 million tonnes (57%), while the remaining tonnages POM were mixed paper/fiber (38%) and newsprint (5%) (AF&PA, 2022).

Of the paper POM, approximately 47.4 million tonnes were collected for recycling, giving a collection rate of 55% (AF&PA, 2022). Cardboard had the highest collection rate at 57%, with 27.9 million tonnes collected, while mixed fiber had a collection rate of 53%, with 17.3 million tonnes collected, and newsprint, a collection rate of 47%, with 2.1 million tonnes collected.

In 2021, 83% of the US population with access to curbside recycling were served by a single-stream collection, including glass, and 3% were served by a single stream collection, excluding glass, while 3% of the population with access to curbside recycling were served by a separate collection of two or more streams (AF&PA, 2021). The remaining 11% were served by other combination collection methods.

Waste paper that is collected from residential sources via a curbside, single-stream system must be sorted from other recyclable material at a materials recovery facility (MRF) before it is baled, and paper can be lost from the system during this process. Across the US, loss rates depend on the age of the MRF equipment, with lower loss rates in more modern MRFs. Based on a conservative estimate, 1.6 million tonnes of paper products were lost from the recycling chain at the sorting stage in 2021, with the total tonnage sorted for recycling being 45.7 million tonnes, giving a sorted-for-recycling rate of 53% (AF&PA, 2022).

Figure 2. Paper products POM, collected, and sorted for recycling in the US, 2021 (million tonnes)



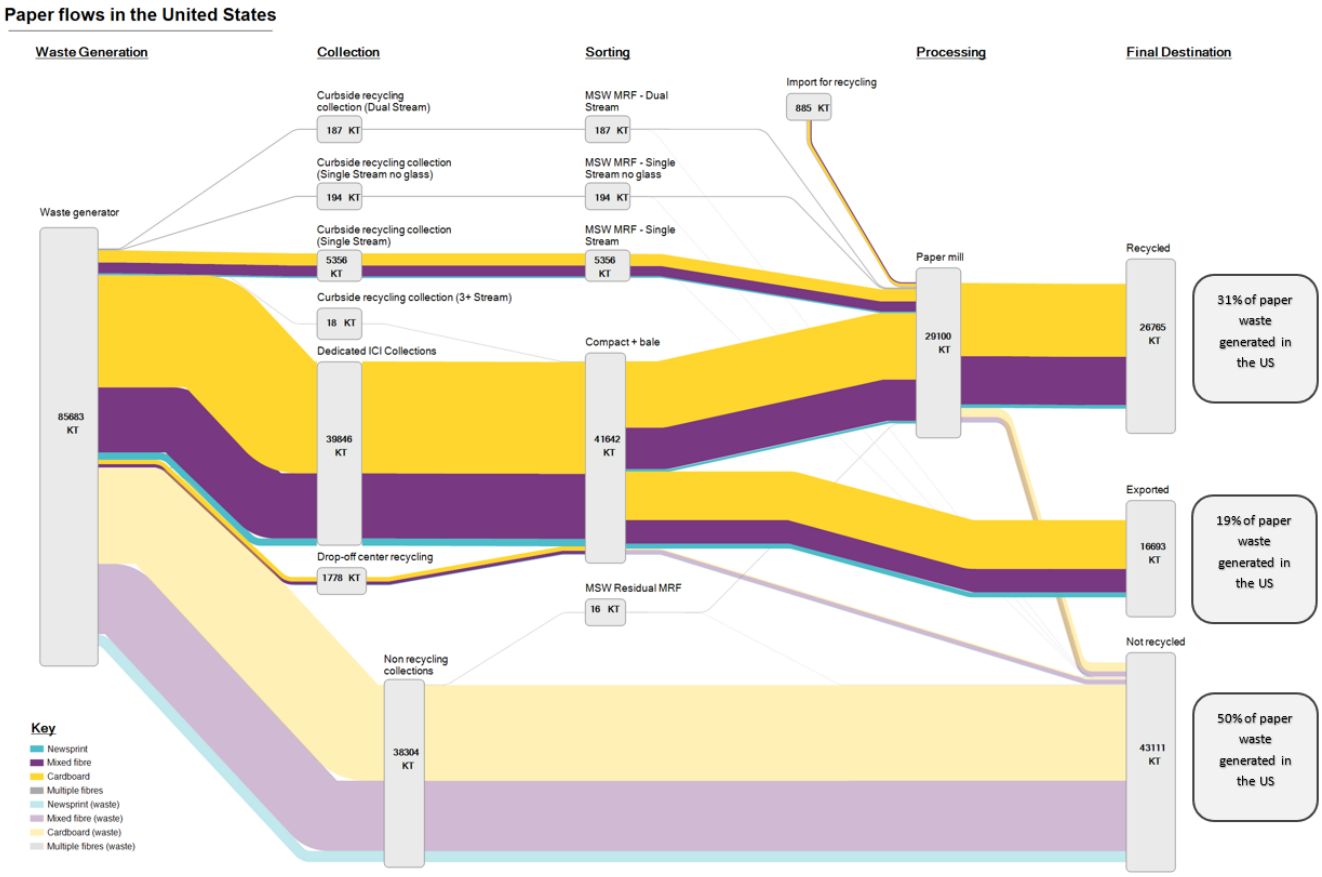
Source: American Forest & Paper Association (AF&PA), 2022 and Circular Ventures, 2022.

In total, 29.1 million tonnes of domestic paper waste (and 0.9 million tonnes imported for recycling) entered domestic paper mills for recycling (AF&PA, 2022). When processing losses are accounted for, 28.1 million tonnes of recycled paper were ultimately used in US paper production. As 67.3 million tonnes of paper were produced domestically in the US in 2021, 41% of this was recycled content.

About 45% of POM paper, or 38.3 million tonnes, was not collected for recycling, representing the first limiting factor to domestic circularity. Furthermore, out of the 16.7 million tonnes of gross waste paper exports from the US in 2021, 13.5 million tonnes (28% of paper collected for recycling) were exported outside of North America (UN Comtrade, 2023). Although this represents a loss from the domestic recycling system, the recycled feedstock can be used in paper production in other countries and therefore reduces overall demand for virgin feedstock globally.

Figure 3 shows estimated paper waste flows in the US in 2021.

Figure 3. Paper waste flows in the United States, 2021 (kilotonnes)



Source: Eunomia Research & Consulting

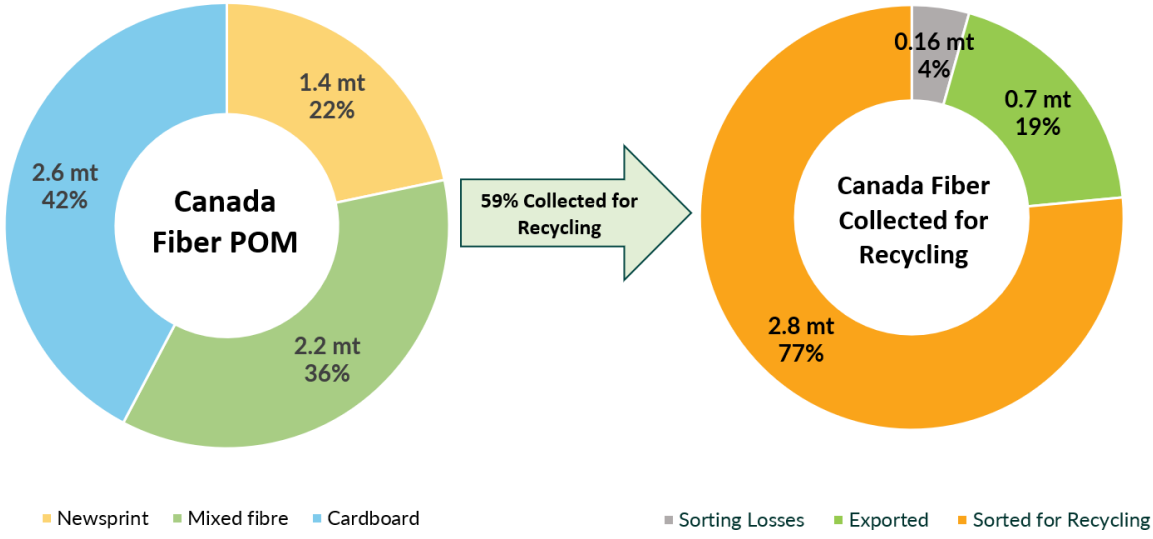
Canada

It is estimated that, in 2020, approximately 6.2 million tonnes of paper were placed on the market (POM) in Canada (FAO, 2020; Pulp and Paper Products Council, 2021). This tonnage comprised

domestic production, which equaled 8.3 million tonnes, minus net exports of 2.1 million tonnes of paper products, with Canada producing more paper products than its domestic market demands and consumes. The majority of paper products POM were cardboard, accounting for approximately 2.6 million tonnes (42%), while the remaining tonnages POM were mixed paper/fiber (36%) and newsprint (22%).

Of the paper that had been placed on the market, approximately 3.7 million tonnes were later collected for recycling, giving a collection rate of 59% (ECCC, 2023) (StatCan, 2023). Cardboard had the highest collection rate, 61%, with 1.6 million tonnes collected, while mixed fiber had a collection rate of 56%, with 1.3 million tonnes collected, and newsprint a collection rate of 60%, with 0.8 million tonnes collected. A combined 3.5 million tonnes were subsequently sorted for recycling (57% of paper POM) (StatCan, 2023).

Figure 4. Paper products placed on the market (POM), collected, and sorted for recycling in Canada, 2020 (million tonnes)



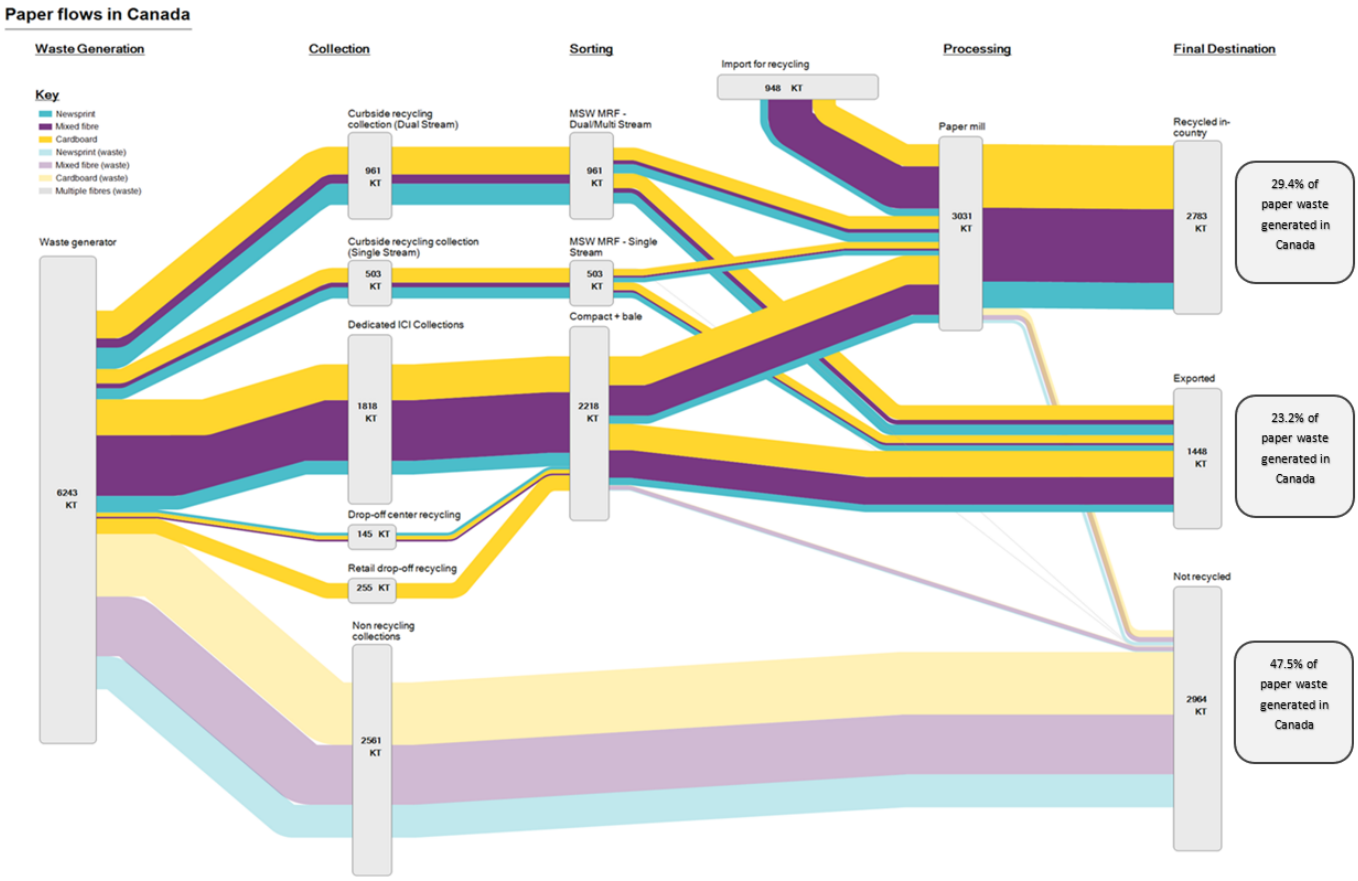
Source: Eunomia Research & Consulting modeling based on ECCC (2020), StatCan (2023) and provincial EPR reports, using US loss rates from American Forest & Paper Association (AF&PA) (2022)

3 million tonnes of paper waste (including ~950 tonnes of paper waste imported for recycling) entered domestic paper mills for recycling). When processing losses are accounted for, 2.8 million tonnes of recycled paper were ultimately used in Canadian paper production. As 8.3 million tonnes of paper were produced domestically in Canada in 2021, it is estimated that 33% of this was recycled content.

Overall, Canada is a net exporter of paper products, with 2 million tonnes of the 8.3 million tonnes produced in the country exported to foreign markets. This exportation removes paper from the domestic system, as it cannot then be collected and sorted in Canada. Approximately 41% of paper POM was not later collected for recycling, meaning that another 2.5 million tonnes were lost from the recycling system. Furthermore, 23% of paper waste generated in Canada is sold to foreign markets and thus removed from the domestic recycling system. Of the 1.5 million tonnes of waste paper exported from Canada in 2020, 0.9 million tonnes were exported outside of North America (UN Comtrade, 2023).

Figure 5 shows waste paper flows in Canada in 2020.

Figure 5. Paper waste flows in Canada, 2020 (kilotonnes)



Source: Eunomia Research & Consulting

Summary

In the US in 2021, approximately 85 million tonnes of paper and paper products were placed on the market (POM), of which 55% was collected for recycling at end of life. In Canada in 2020, approximately 6 million tonnes of paper and paper products were POM in Canada, of which 59% was collected for recycling at end of life. In both the US and Canada, the difference between the amount collected for recycling and the amount sorted for recycling rate is around 2%, indicating a

similar level of sorting efficiency in both countries. The US and Canada are both net exporters of waste paper (exporting 13.5 million tonnes and 0.9 million tonnes outside of North America annually) (UN Comtrade, 2023).

3.2 Policy and Regulatory Frameworks

In the US and Canada, waste management responsibilities are shared by federal, provincial/territorial/state, and municipal governments. In both countries, there is no material-specific federal policy for managing paper waste.

In the US, four states have passed EPR policies, with more likely to follow. These programs will include a range of paper-based packaging. While ten US states have deposit-refund system (DRS) for beverage containers, none of these cover paper beverage containers (milk cartons, juice cartons, etc.). Bills would need to be amended to enable these programs to cover paper-based containers.

EPR programs are at various stages of development and implementation across Canada. Some provinces are implementing EPR programs that include a broad range of paper products. Three provinces currently have full EPR for residential paper waste (British Columbia, Ontario, and Québec), and by 2026 a total of 11 provinces and territories should have EPR for paper and paper products. And nine provinces and two territories have a DRS, of which nine accept paper-based beverage containers, while one (Québec), but will do so from March 2025.

3.3 Key Barriers to Circularity

Table 1 presents a summary of the key barriers to paper circularity for both countries, identified at each stage of the value chain (collection, sorting, recycling, and trade), as well as those barriers associated with the policy landscape and other key themes. The red, amber, and green coloring (RAG rating) represents the degree of barrier severity to paper circularity, with red representing the greatest barriers and green the least severe barriers[4]. While barriers are present in all stages of the value chain, the most serious barriers are found at the collection and recycling stages.

Table 1. Barriers to paper circularity in Canada and the US, according to value chain stage

Stage	Country	RAG rating	Area of value chain stage / theme	Barrier to circularity
Paper production			Paper products	The value chain favors the use of virgin fiber in manufacture, through demand for specific aesthetic characteristics for end products, such as color and brightness, which are more difficult to achieve when paper recipes include recycled content. The perception is that consumers would be less willing to buy off-color products, and this places a limit on the market demand

[4] In the full study, the color coding is simply red for the left two columns that outline the challenges and barriers to circularity; green for the right two columns that outline the suggested solutions.

Stage	Country	RAG rating	Area of value chain stage / theme	Barrier to circularity
				for recycled fiber. Of the paper produced in the US in 2021, 40% was recycled content (AF&PA, 2022), while of the paper produced in Canada in 2020, 33% was recycled content (Eunomia estimate).
Collection			Collection practices	Single-stream collection in both countries results in contamination from non-target materials, and high quality fibers being collected mixed with lower quality fibers, which results in a mixture of papers with different fiber lengths and levels of inking. In the US, among the population with access to curbside collection in 2021, only 3% received separate collections of two or more material streams (AF&PA, 2021). Furthermore, use of uncovered containers means that paper is exposed to wet weather, leading to increased moisture content and, at worst, heavy contamination by water and other substances in the recycled materials.
			Collection scheme design	A lack of harmony across collection schemes in different jurisdictions has resulted in consumer confusion about what items are recyclable. This inconsistency also poses challenges for creating uniform messaging or labeling to educate consumers about recycling practices.
			Collection rates	In the US and Canada, approximately half of all paper products placed on the market are not collected for recycling. In general, collection rates are lower in the residential sector than the industrial, commercial, and institutional (ICI) sector. Lack of access to recycling collection remains a problem for some consumers, especially in rural areas.
			Collection costs	Residential curbside collection is costly for municipalities, and collections are vulnerable to fluctuations in global paper prices, global fuel costs, and labor expenses, all of which can influence the cost and efficiency of collecting paper.
Sorting			Sorted paper bales	The most common type of paper bale produced by materials recovery facilities (MRFs) from single-stream residential collection is mixed paper, which is a low-quality fiber with limited end markets.
Recycling			Packaging specific recycling challenges	Fiber based alternatives to plastic packaging are often composed of molded pulp (i.e., a paper packaging material made of paper and water). However, not all recyclers can recycle molded pulp, as the technology for doing so is new, and there is no mature recycling end market for the material. Some fiber-based applications (such as multi-material and multilayer packaging) still include plastic elements to preserve barrier and moisture properties, and these may create difficulties in the paper recycling process.

Stage	Country	RAG rating	Area of value chain stage / theme	Barrier to circularity
				High wet strength paper packaging applications must be pulped using specifically designed processes.
			Paper mills	Many mills were built prior to recycling becoming widespread and were built beside the forest being harvested and designed to use this virgin fiber as their feedstock. As a result, they may not be ideally located for the reverse logistics and associated expense required to switch to using recycled fibers as their feedstock. In addition, it is difficult for paper mills to change their paper recipes to include more recycled content, as this requires changing processes and equipment. Also, recipes for end-products are set and require very specific fibers, which are typically secured via long-term contracts. This has resulted in a lack of demand for recycled fibers. Mills generally lack the capability to further sort the paper bales delivered to them into the specific grades they require, and therefore if bales are grades of poor quality, they cannot be used.
Trade			Export rates	A significant tonnage of waste paper is exported outside North America, due to low domestic demand and competition from international markets.
			Balance of trade	More paper packaging is imported from abroad than is manufactured domestically, with domestic manufacturing capacity limiting demand for recycled fiber.

4 Recommendations to Increase Circularity

A range of policy approaches and waste management practices are available to help overcome the barriers to paper circularity in Canada and the US listed above. While some of these serve as solutions to specific problems along the value chain, many have the potential to be leveraged to address multiple issues. Furthermore, as the stages of the value chain do not operate in isolation but rather influence each other, often implementing measures at one point will result in benefits downstream. The key recommendations arising from this milestone study are discussed below.

4.1 Industry Practices

Multi-stream collections

Collecting paper separately from other materials improves the quality of the collected material by reducing contamination, which in turn leads to lower recycling costs. An analysis of the impact of different programs has shown that the average contamination rate is higher for single-stream

collection systems than for dual- or multi-stream (Runsewe & Celik, 2021). In the US, municipalities in New York, New Jersey, Pennsylvania, and Florida have all reported positive results from switching from single-stream to dual-stream recycling (Wallace, 2021).

Therefore, introducing multi-stream collection services in which paper is collected as a separate stream (or at least is kept separate from glass), is a way of overcoming barriers to circularity in both the collection and sorting stages, while also retaining more waste paper within domestic recycling markets. Such service designs could be trialed in pilot programs funded via grant support. This would help to improve the quality of fibers collected and aid in the sorting of higher quality bales within materials recovery facilities (as MRFs are better able to sort paper into bales of specific grades or types of paper when paper is collected separately from other materials, which is more likely to produce a higher quality overall due to reduced contamination). Multi-stream collections would also result less waste paper being lost to export as it would be of higher quality and therefore more desirable on the domestic market.

Covered bins

Covered bins for waste paper collection in would help protect it from wet weather at the curb, reducing exposure to moisture and the risk of water contamination. Policy makers could provide financial support, via grants, for collection services to introduce such bins, which would be beneficial in multi, dual, and single-stream collections. This would improve the quality of the fibers collected, resulting in less paper ending up sorted into mixed paper bales, and less paper lost to export.

4.2 Policy Approaches

Extended producer responsibility (EPR)

Extended producer responsibility (EPR) is an environmental policy in which producers bear the financial responsibility for managing the packaging they place on the market at end-of-life. It can be leveraged to promote circularity in a number of ways, including:

- Introducing requirements for producers to fund specific types of collection services where collection rates are currently low. For example, in Canadian provinces with full EPR programs, producer responsibility organizations (PROs) could be directed to set service rate targets for multi-family residential buildings. More generally speaking, EPR could be used to set collection and recycling targets for both residential and industrial, commercial, and institutional (ICI) collections.
- EPR can be effective at improving collection rates for ICI paper. Belgium has an EPR program to fund ICI packaging waste management, and this had helped to raise its recycling rate for ICI packaging to 91.5% by 2020, with 100% of commercial paper and cardboard waste being recycled (Valipac 2022).
- Shifting the financial burden of collection from municipalities onto producers, thereby helping to financially insulate collection services from market fluctuations.
- Setting minimum recycled content targets for products. EPR product fees can also be modulated to incentivize the inclusion of recycled content by providing a bonus to those

who integrate a given percentage of recycled fiber. Fee modulation could also be used to incentivize design for recycling, for example, to stimulate solutions for overcoming the challenges associated with recycling certain types of fiber-based packaging, such as molded pulp and composites.

- Using funds from EPR to finance investments in recycling infrastructure, such as upgrading MRFs for better paper sorting and removal of plastic contamination, and either opening new 100% recycled content mills and/or retrofitting existing mills to accept more recycled fibers. Such investments would help to overcome the barriers associated with low quality fibers and mixed paper bales, while also making it economically viable for paper mills to use more recycled content.
- Using funds from EPR to finance education and outreach to improve consumer participation in collection schemes, improving both collection rates and quality of material collected (due to reduced contamination thanks to improved recycling behaviour).

Deposit-refund systems (DRS)

A deposit-refund system (DRS)—also called a 'container deposit system' or 'bottle bill'—places a monetary deposit on a product, paid by the consumer at the time of purchase, which is refunded when the consumer returns the product to a designated location for reuse and/or recycling.

While DRS commonly covers glass, aluminum, and PET (polyethylene terephthalate) plastic beverage containers, expanding such systems to include beverage cartons provides a way of increasing both the tonnage and quality of fibers collected. Canada is the only North American country at present to have DRS for beverage cartons (in nine provinces and territories), and its highest performing DRS system (Alberta), achieved return rates of 70.5% for aseptic containers and 74.2% for gable-top containers in 2021.

Additionally, even if fiber-based beverage cartons are not collected in a DRS, if the DRS covers glass beverage containers, then this can help to reduce the volume of glass in the curbside collection system, thus reducing glass contamination and improving the quality of fibers collected at the curbside.

The resultant higher-quality paper collected when a DRS is in place (either specifically for fiber-based beverage cartons or excluding them, but covering glass) is less likely to be sorted into low-value mixed paper bales and is therefore also less likely to be lost from the Canadian and US economies through exports because domestic demand is higher for better quality material.

Recycled content targets

Recycled content targets could help to reorientate the paper value chain away from its historical dependance on virgin fibers, toward using more recycled fibers. Targets would provide a clear market signal for paper mills by creating stable demand and prices for recycled fiber. This would increase the economic viability for mills to make the investments in technology necessary to incorporate more recycled content into their paper recipes, as well as to process more low-quality fibers, such as mixed paper bales. Targets can also be used to drive innovation to overcome the challenges associated with particular paper products, such as molded pulp packaging, as

manufacturers will be encouraged to invest in research and development to include more recycled content in these products.

In practice, government at both the national/federal and state/province/territory levels could update or pass new legislation that would require paper packaging and products to have a certain percentage of recycled content. For example, California's Public Contract Code sets a recycled content target of 30% for printing and writing paper and other paper products, with some exceptions—either higher or lower—for certain products. Any percentage targets set could then increase with time to allow industry to gradually scale up use of recycled fiber.

Consistent collection services

To address the consumer confusion resulting from a lack of consistency across different collection services—which results in lower service participation and higher contamination—policy makers could seek to harmonize collections. The potential solutions for achieving this include:

- Harmonizing/standardizing the materials that can be recycled regionally, in a jurisdiction, and/or nationally.
- Implementing country-wide labeling requirements for recyclability, including consistent color for containers/bins for recycling, based on industry best practices.
- Implementing consistent landfill bans for paper and cardboard across jurisdictions and establishing appropriate enforcement.

5 Conclusion

The findings from these milestone studies on paper, plastics, and bioplastics waste management will provide key input for defining and developing appropriate pilot projects in Phase II of the Commission for Environmental Cooperation's Operational Plan 2021 Project, "Transforming Recycling and Solid Waste Management in North America."

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